

Bacterial Quorum Sensing



Camilo Gómez

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- Three archetypes of bacterial Quorum sensing
 - Gram-positive bacteria
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- *V. cholerae*
- QS in synthetic biology
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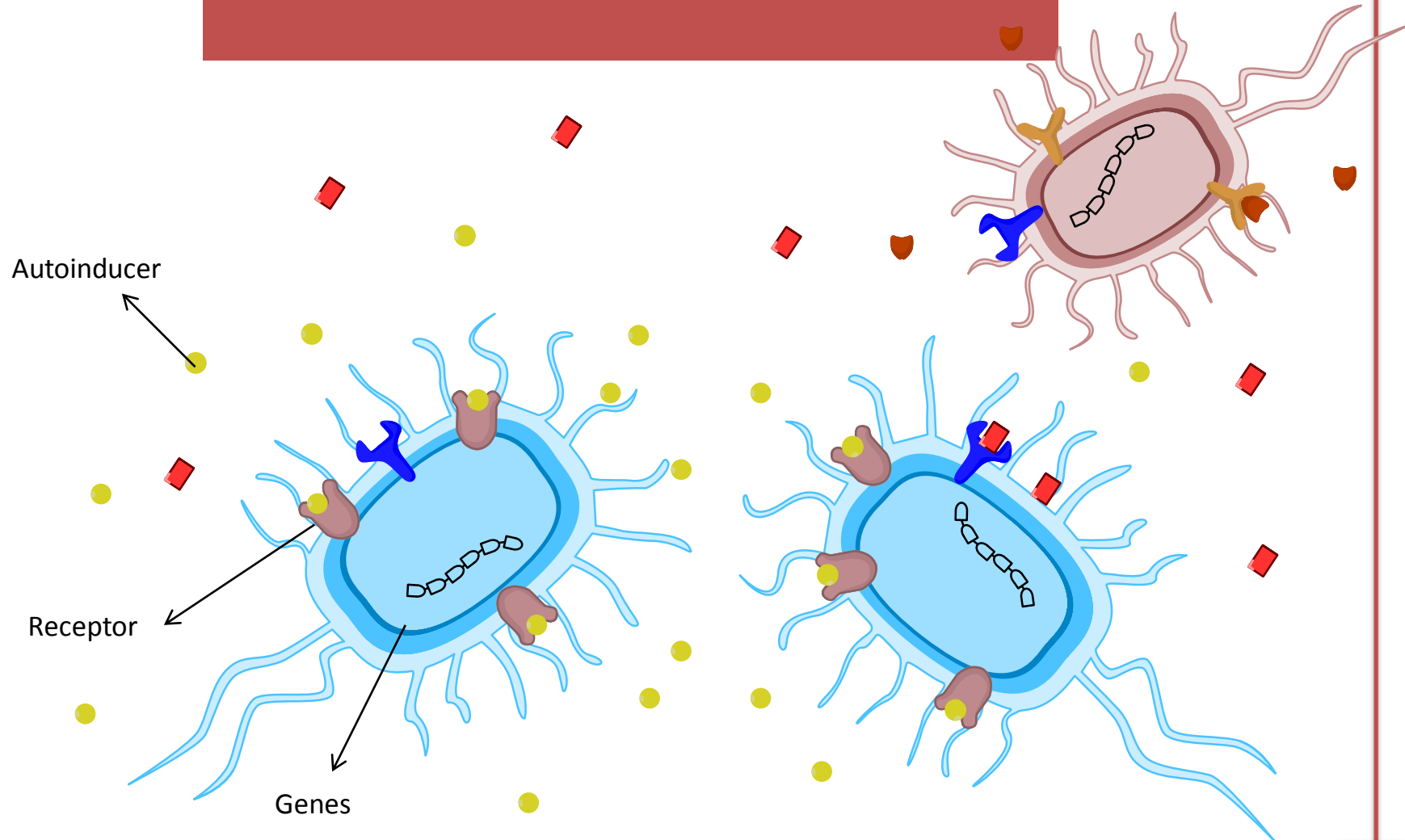


Euprymna scolopes



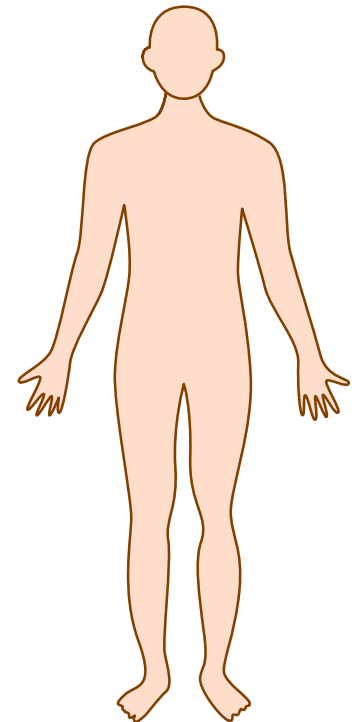
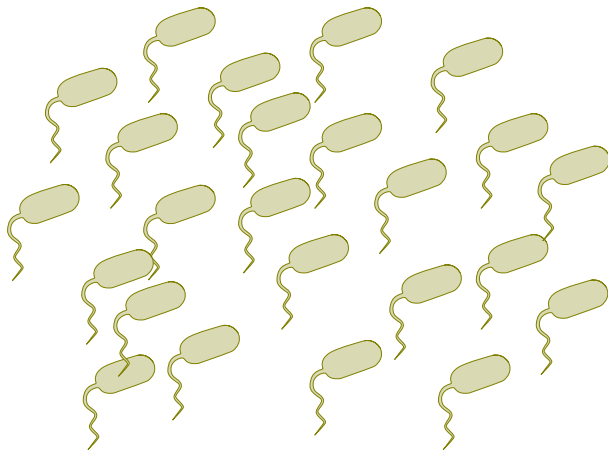
Aliivibrio fischeri

Quorum sensing



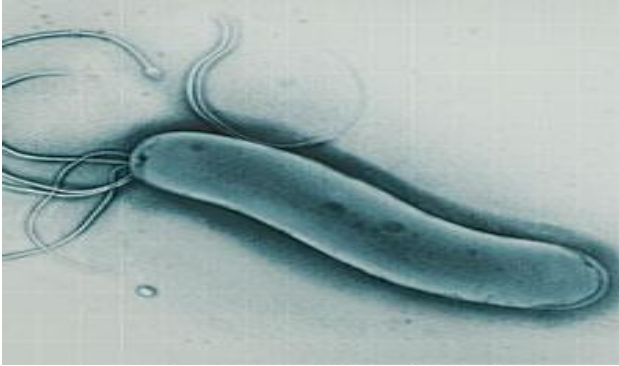
Number and coordination

0,5 – 5,0 μm



Cholera: *V. cholerae*
Tuberculosis: *M. tuberculosis*
Carbuncle: *B. anthracis*
Bubonic plague: *Y. pestis*
Ulcer: *H. pylori*
...

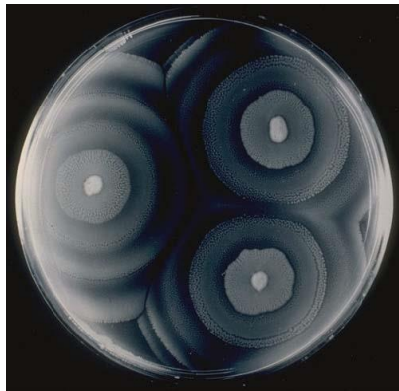
Quorum sensing



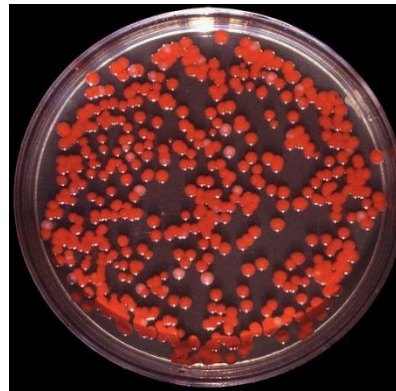
Virulence



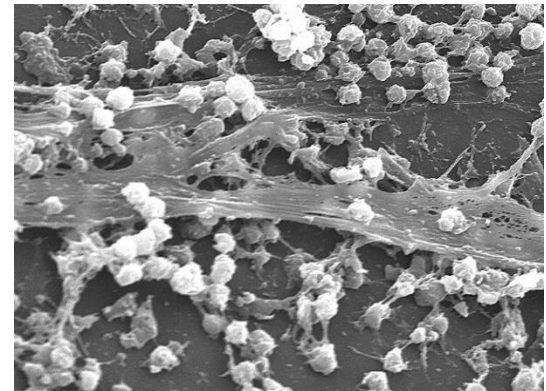
Bioluminescence



Swarming



Pigments

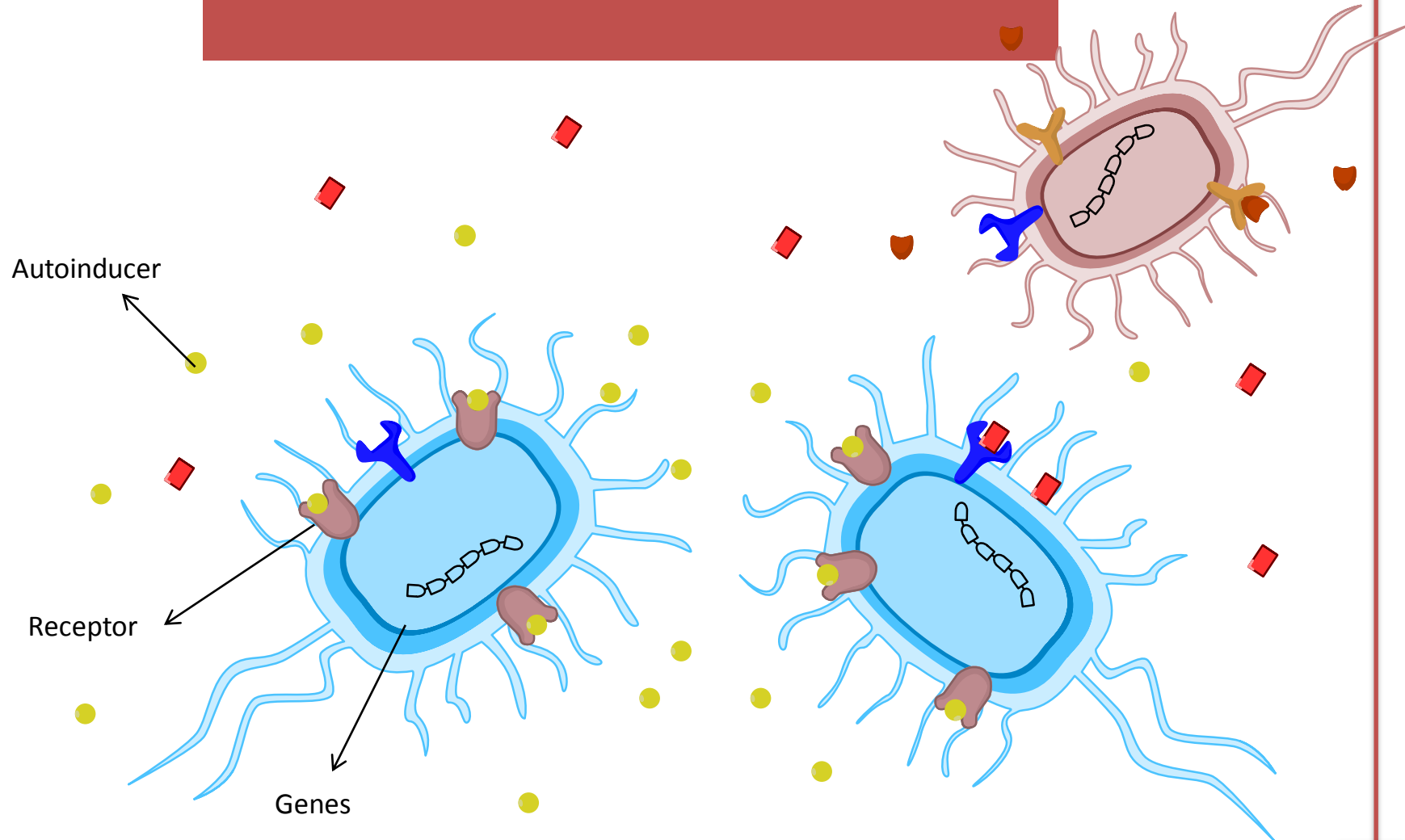


Biofilms

The question

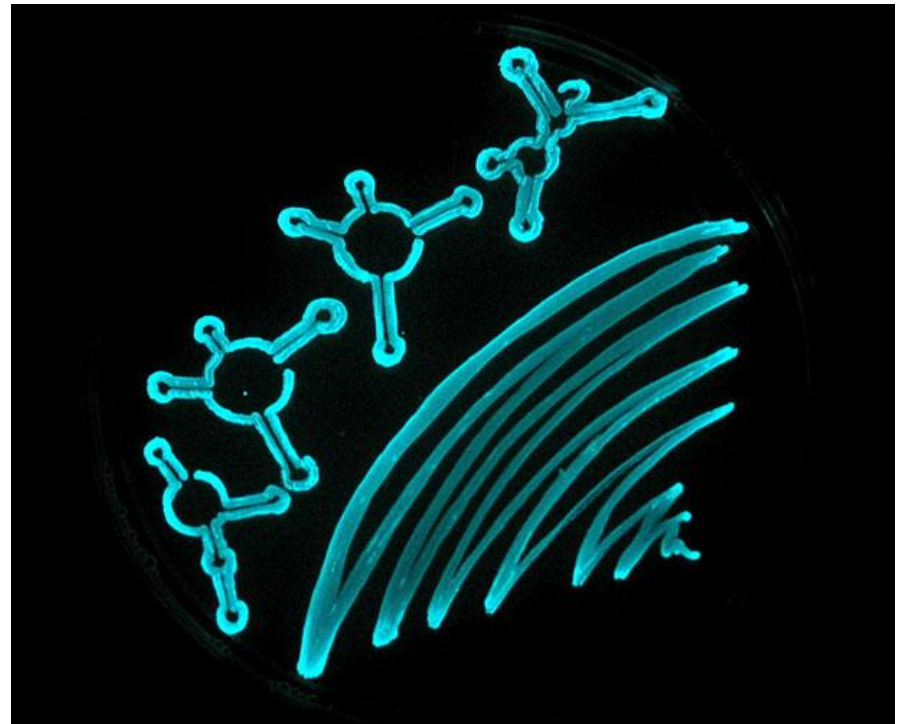
«Social life» in bacteria?

Quorum sensing



DS, QS & ES

- Diffusion sensing
- Quorum sensing
- Efficiency sensing



LETTERS

Cooperation and conflict in quorum-sensing bacterial populations

Stephen P. Diggle¹, Ashleigh S. Griffin², Genevieve S. Campbell¹ & Stuart A. West²

PERSPECTIVES

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OPINION

Does efficiency sensing unify diffusion and quorum sensing?

Burkhard A. Hense, Christina Kuttler, Johannes Müller, Michael Rothballer, Anton Hartmann and Jan-Ulrich Kreft

Opinion

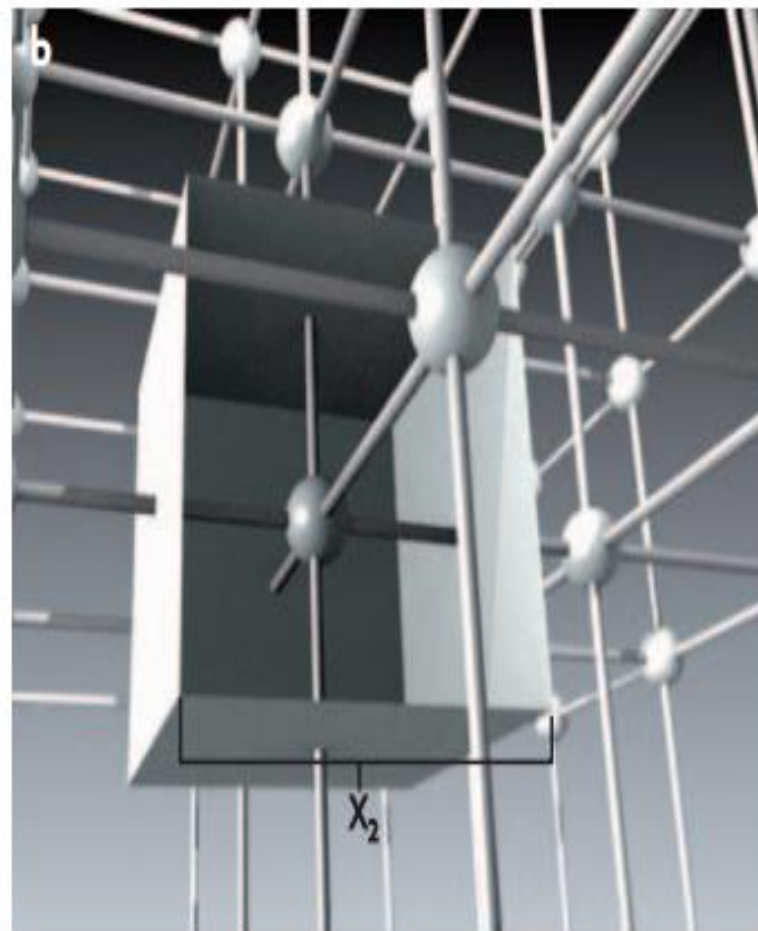
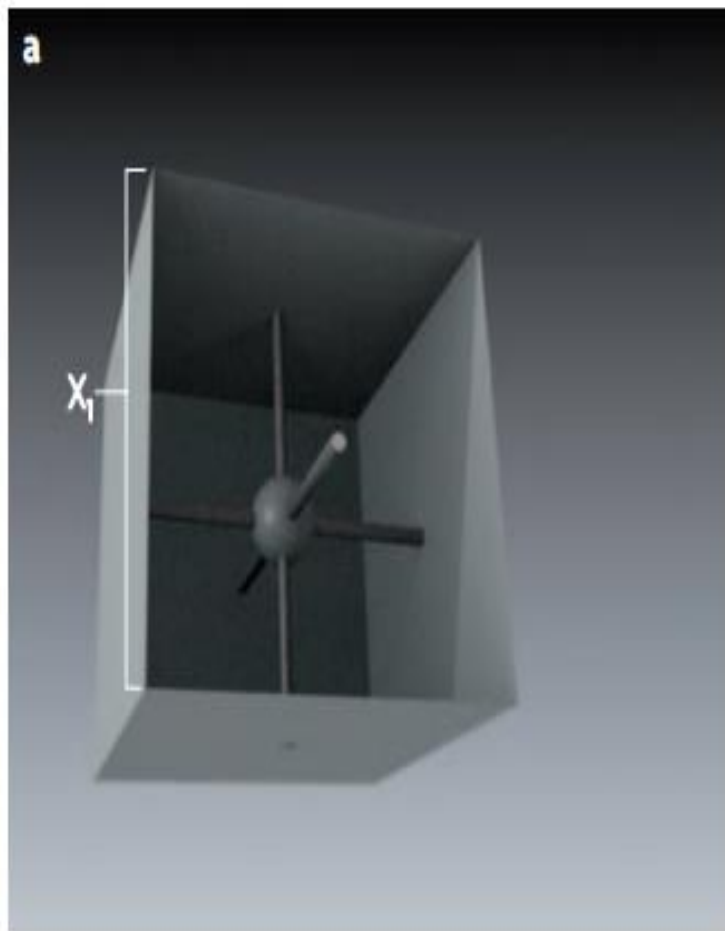
TRENDS in Microbiology Vol. 10 N

Is quorum sensing a side effect of diffusion sensing?

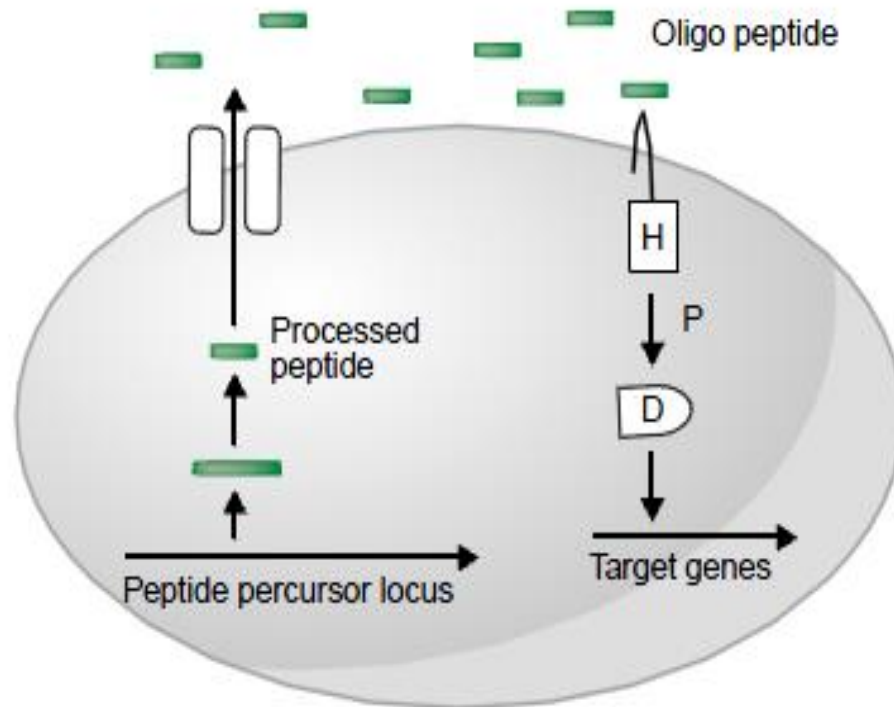
Rosemary J. Redfield

Many bacteria appear to communicate by releasing and sensing autoinducer molecules, which are believed to function primarily as sensors of population density. However, this quorum-sensing hypothesis rests on very weak foundations, as neither the need for group action nor the selective condition required for its evolution have been demonstrated. Here, I argue for a more direct function of autoinducer secretion and response – the ability to determine whether secreted molecules rapidly move away from the cell. This diffusion sensing allows cells to regulate secretion of degradative enzymes and other effectors to minimize losses owing to extracellular diffusion and mixing.

Published online: 10 July 2002



Gram-positive bacteria



Oligopeptide Autoinducers

B. subtilis/ComX

ADPITRQWGD

B. subtilis/CSF

ERGMT

S. aureus/subgroup 1

YSTCDFIM
 S-C=O

S. aureus/subgroup 2

GVNACSSLF
 S-C=O

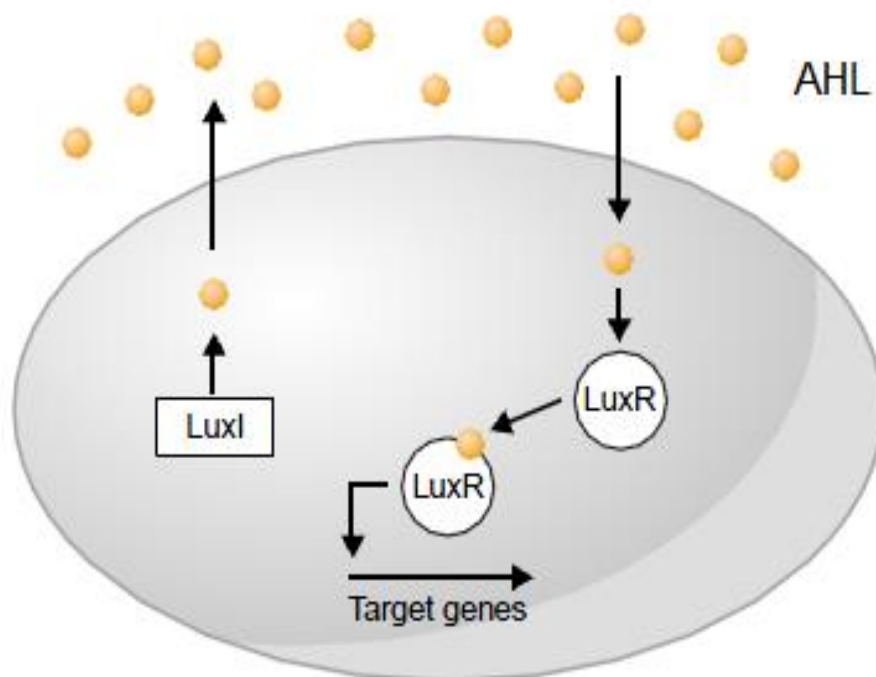
S. aureus/subgroup 3

YINCDFLL
 S-C=O

S. aureus/subgroup 4

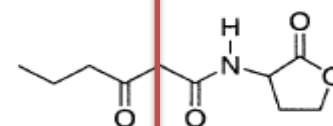
YSTCYFIM
 S-C=O

Gram-negative bacteria

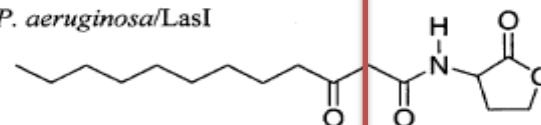


Acyl-Homoserine Lactone Autoinducers

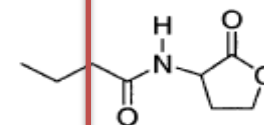
V. fischeri/LuxI



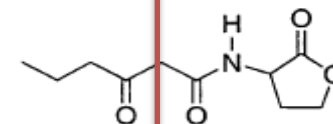
P. aeruginosa/LasI



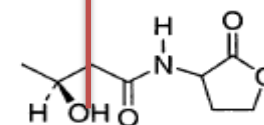
P. aeruginosa/RhlI



P. stewartii/EsaI

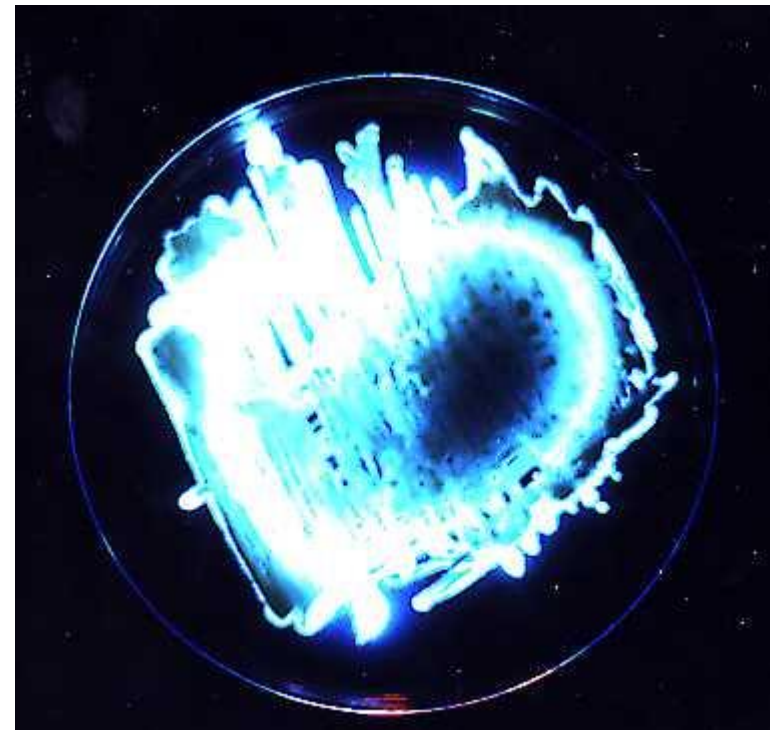
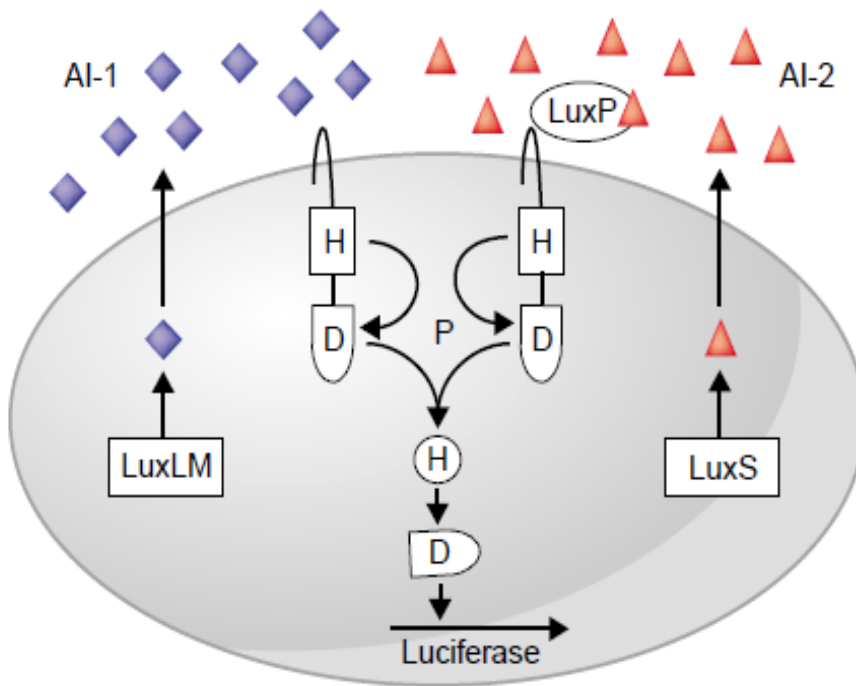


V. harveyi/LuxLM

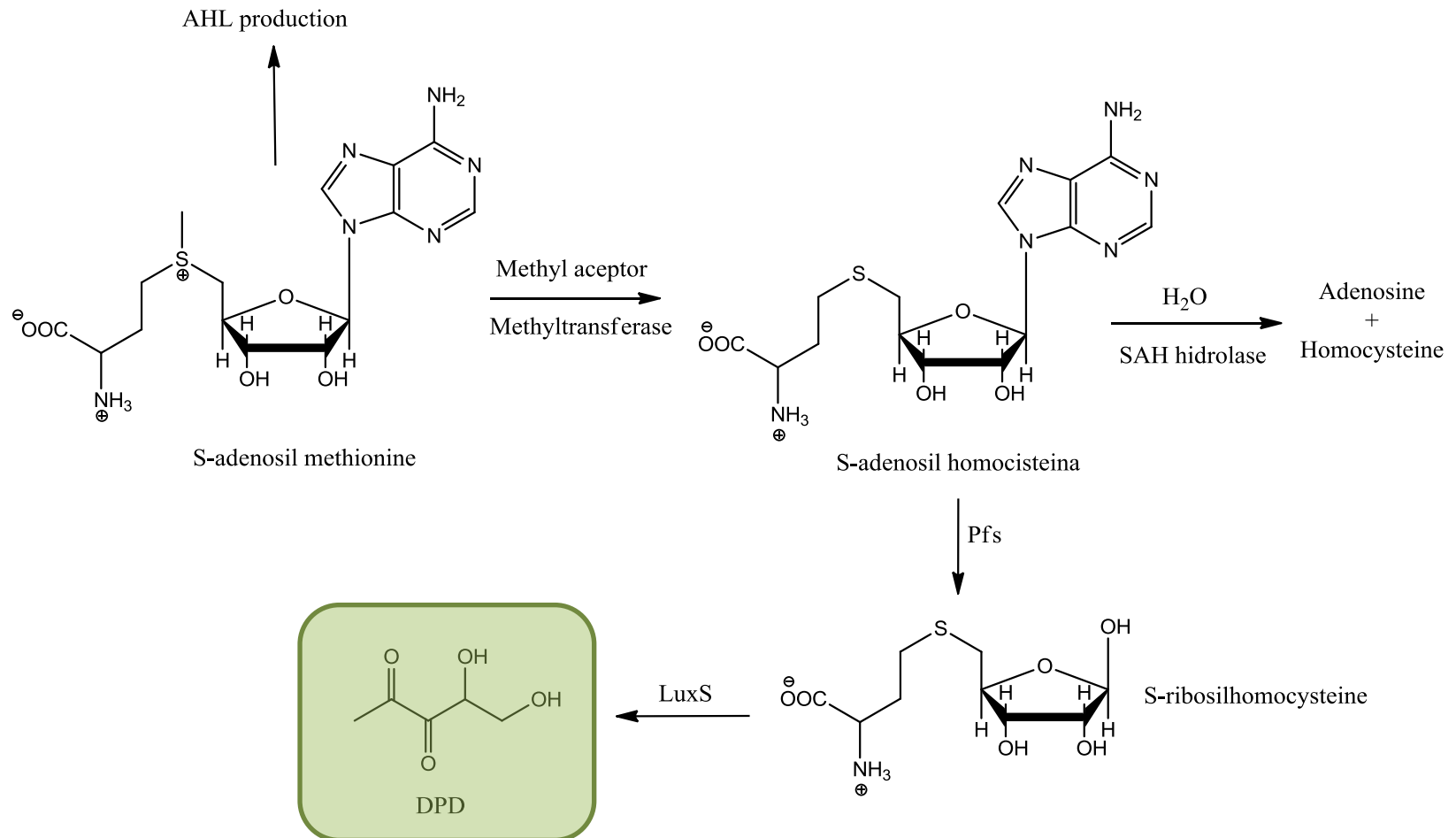


Universal signal AI-2

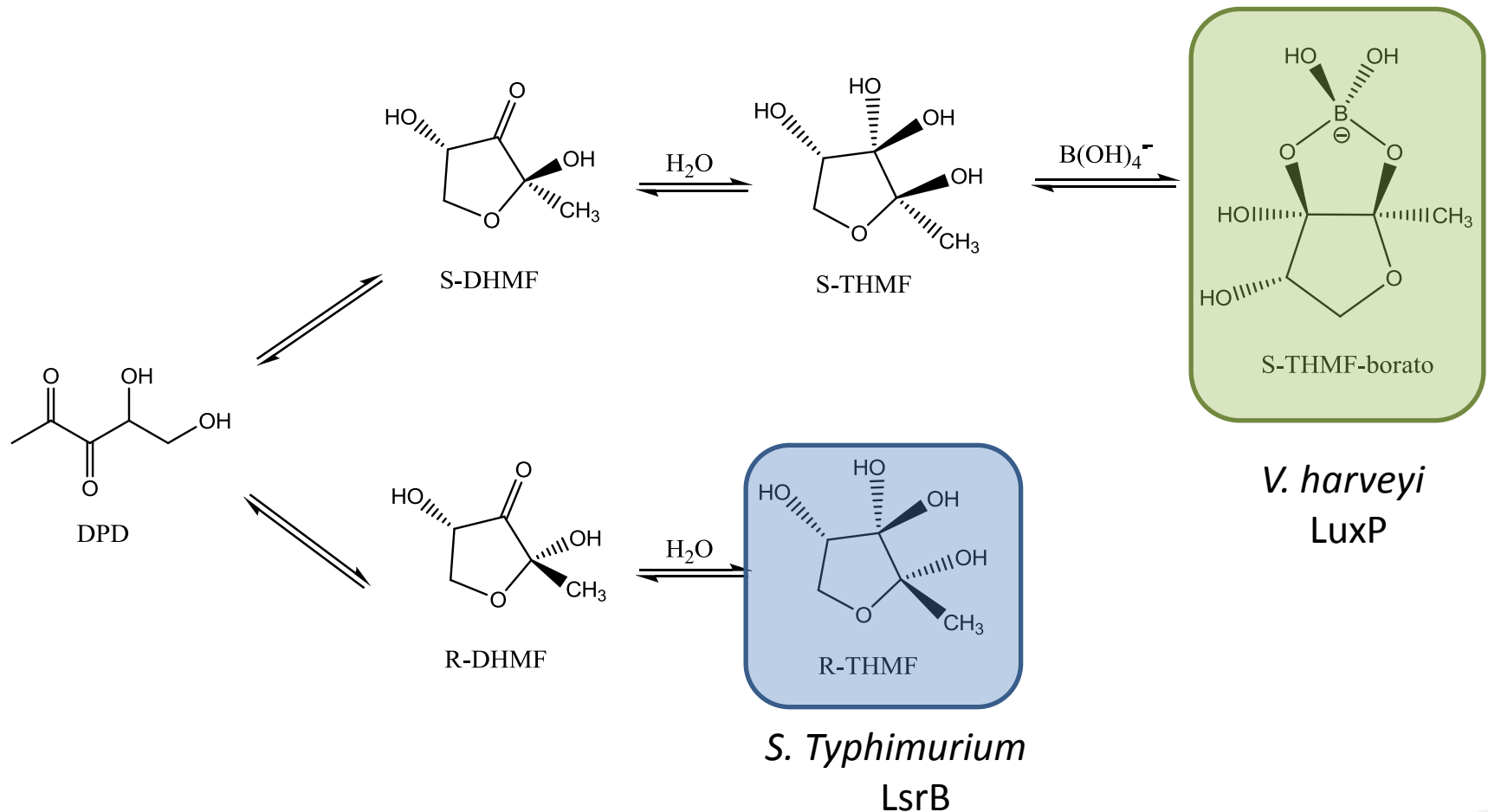
Vibrio harveyi uses two systems of quorum sensing for the same function



Universal signal AI-2

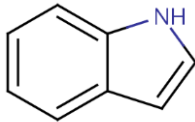
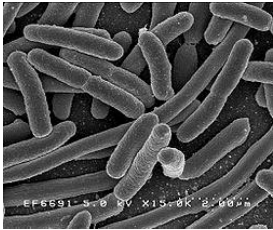


Universal signal AI-2

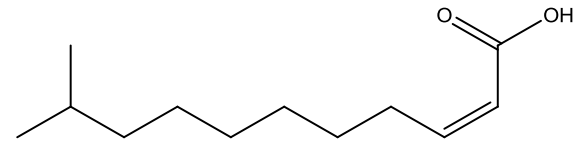


Other signals

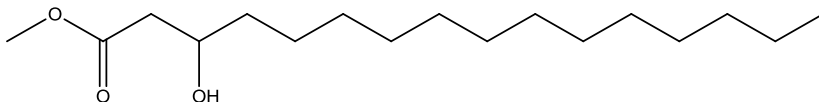
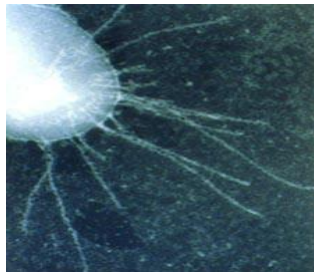
Escherichia coli: Indol



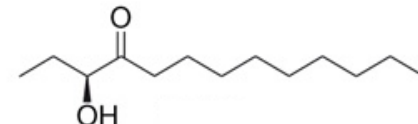
Xanthomonas campestris: DSF



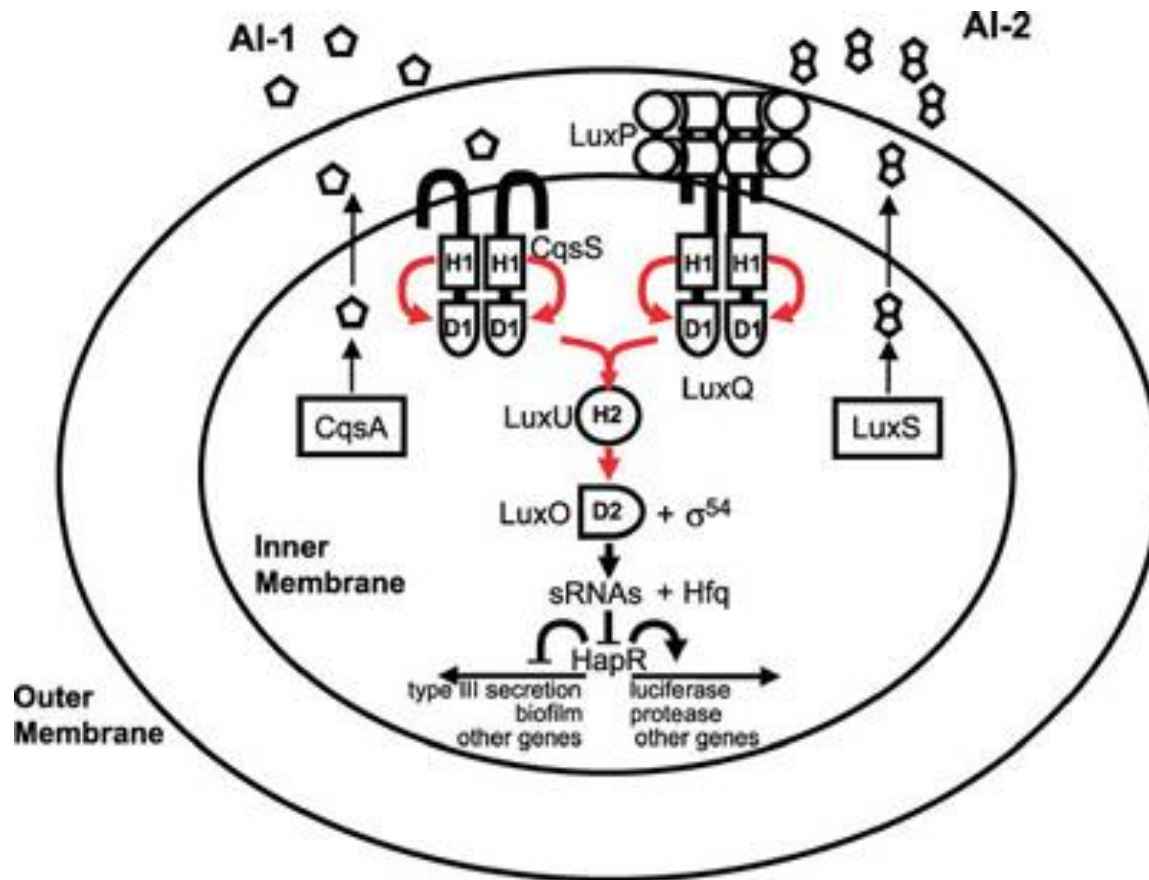
Ralstonia solanacearum: 3OH-PAME



Vibrio cholerae: CAI-1



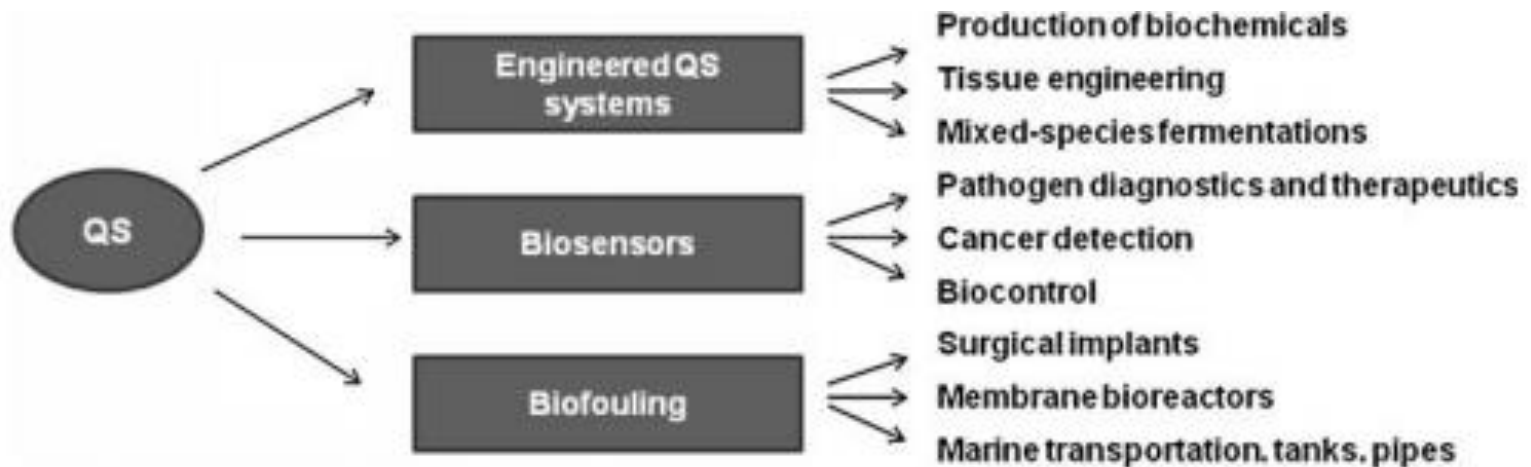
V. cholerae



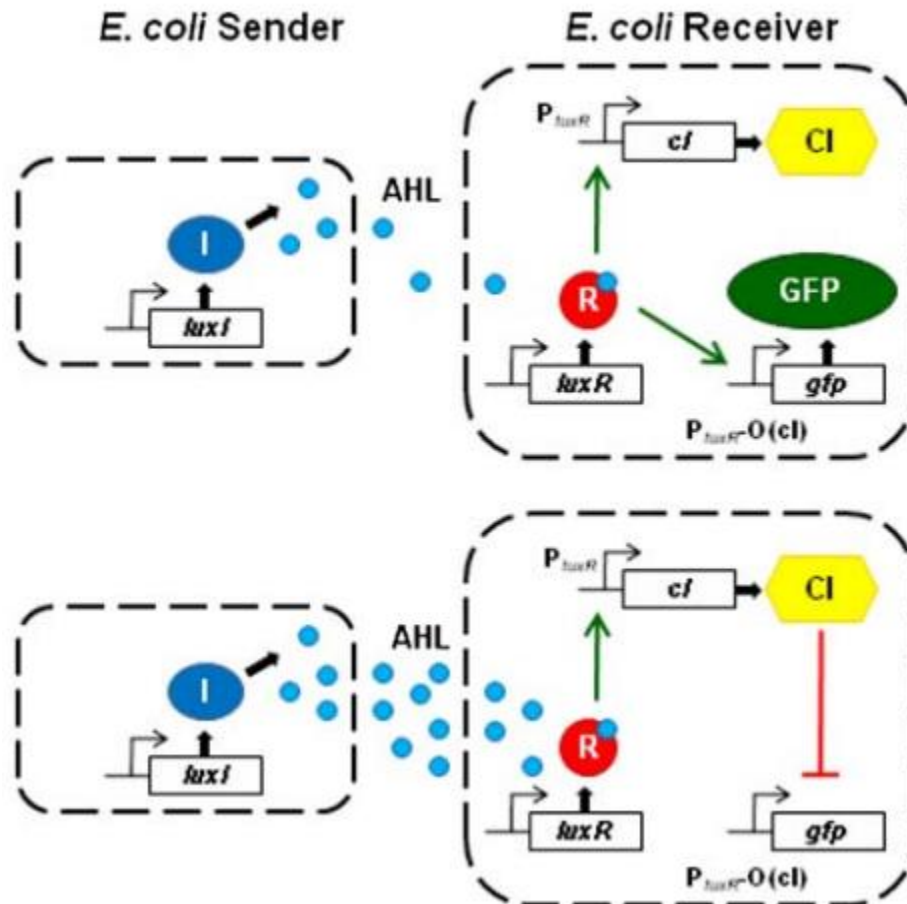
Biosensor



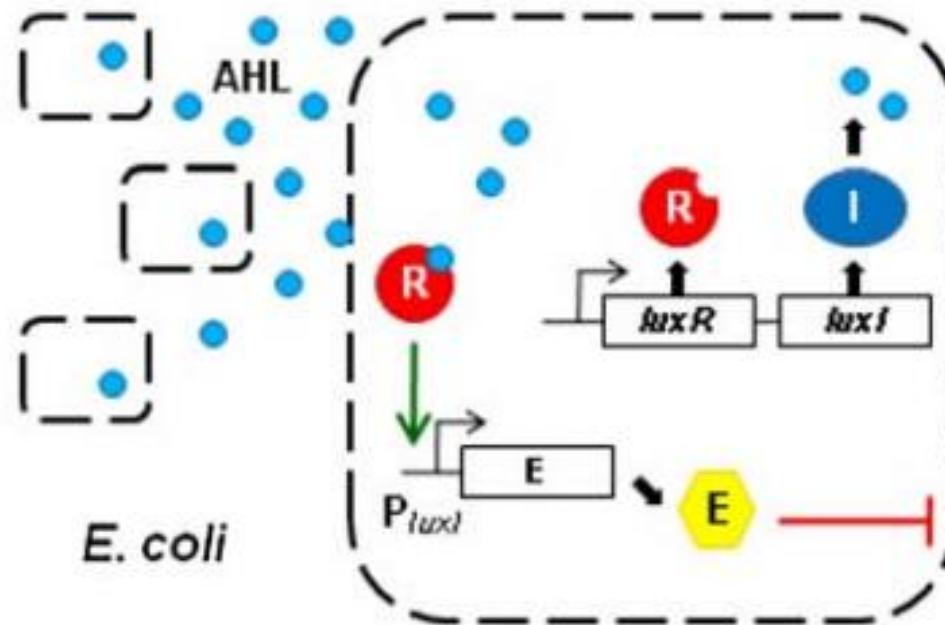
QS in SB



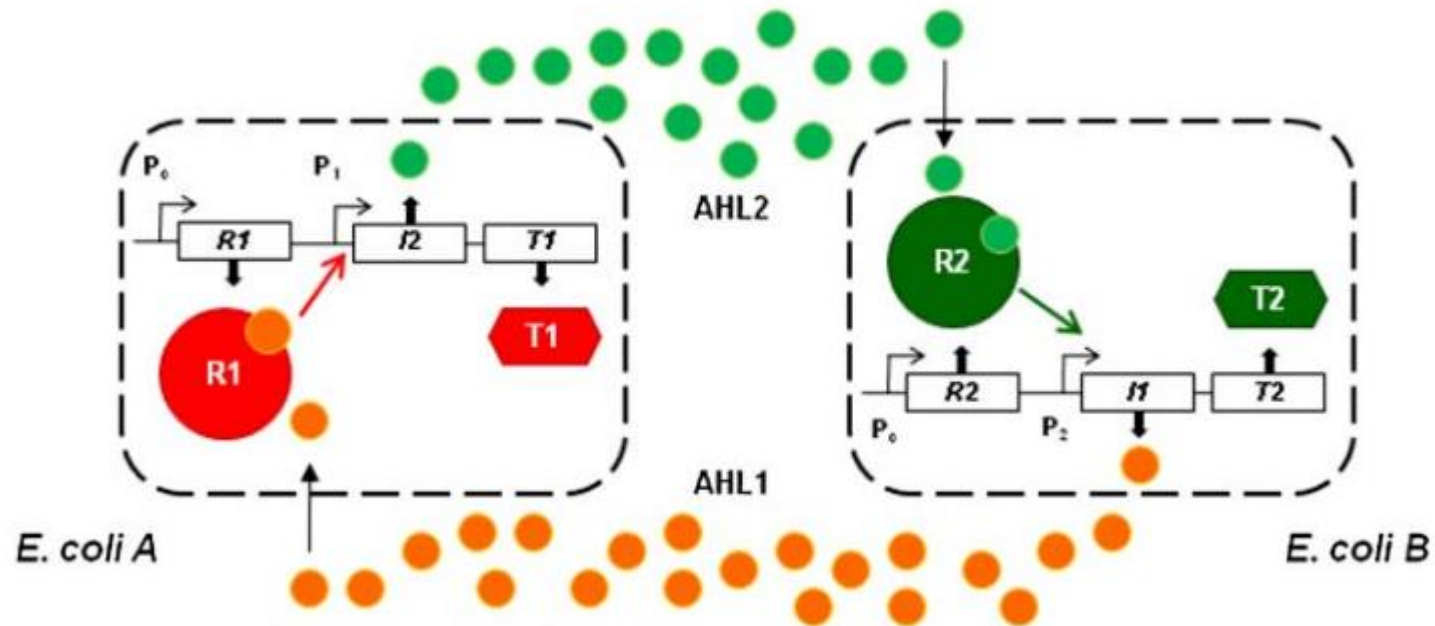
QS in SB



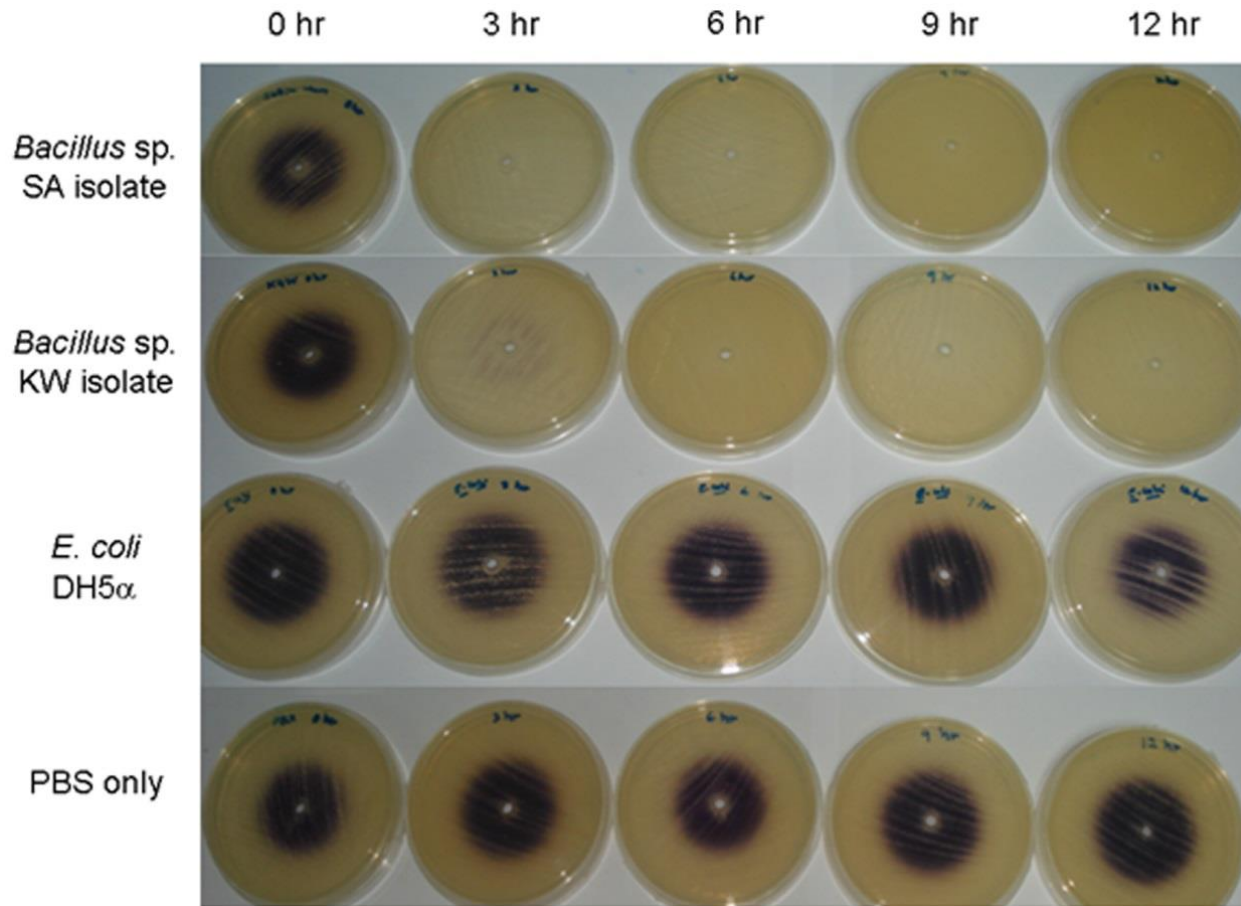
QS in SB



QS in SB



Quorum quenching



Quorum quenching

- Antagonismo *Bacillus* - *Pseudomonas*

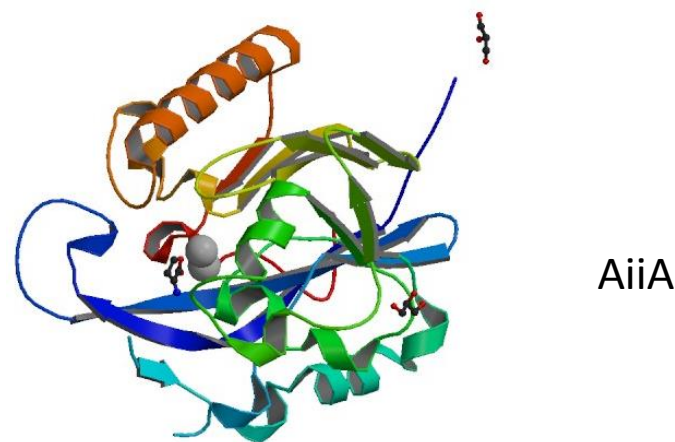
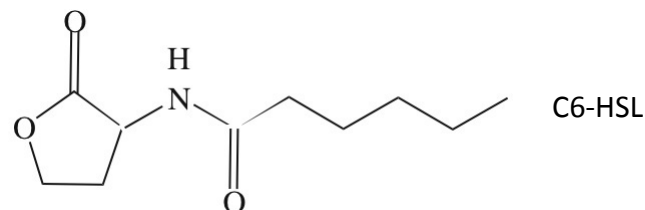
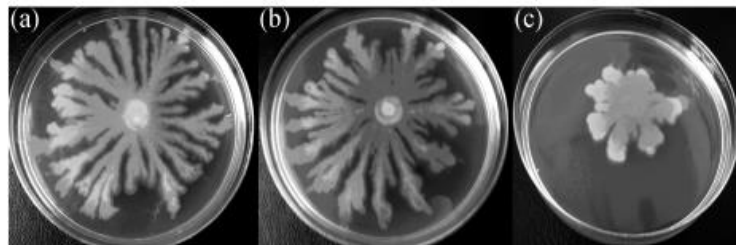


Effects of quorum sensing autoinducer degradation gene on virulence and biofilm formation of *Pseudomonas aeruginosa*

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Conclusions

- Bacteria are constantly «talking» to each other
- Quorum sensing is a census system and it carries out essential functions in bacteria, including interactions between them.
- The inhibition and the induction of bacterial quorum sensing have too many useful applications.

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Roy V. et al. (2012): **AI-2 analogs and antibiotics: a synergistic approach to reduce bacterial biofilms**, Applied Microbial And Cell Physiology (*Online first*).

QUIZ

1) Complete la tabla:

AHL	
	Gram positivas
AI-2	
	<i>Vibrio spp.</i>

2) ¿Por qué no sería útil un biosensor de *Vibrio cholerae* con el sistema LuxS-LuxP?